

laid on the point that the balance between sympathetic and parasympathetic must be brought back to normal level; adequate resistance to disease is not a function either of the sympathetic system or of the parasympathetic system, but of the equilibrium between them. Disease may occur equally when either system is overacting at the expense of the other, and it is probable that the great success of prophylactic vaccination as compared with the more meagre results of curative vaccination may depend on the fact that in the former case the subject is healthy and is in a state of endocrine equilibrium, whereas in the latter case other conditions prevail. Any tissue performs its functions best when under physiologically normal conditions, and it cannot be supposed that the tissues which are concerned in the mechanisms of defence are exceptions to this rule.

EPIDEMIC HICCUP AND ENCEPHALITIS LETHARGICA.

REPORT OF A CASE OF EPIDEMIC ENCEPHALITIS SHOWING LETHARGY, CRANIAL NERVE PALSIES, MYOCLONUS, AND HICCUP,

BY

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The purpose of this communication is to report a case of epidemic encephalitis exhibiting in one individual many of the varied manifestations of this protean disease.

M. M., aged 16, a healthy-looking well developed girl, was admitted to the London Hospital on July 18th, 1923. The mother says she had St. Vitus's dance as a child. In November, 1918, she had an acute illness. She was in bed a week with severe headache, sleepy all day but restless at night, and delirious for a day or two. She did not complain of visual impairment or diplopia at that time. Drooping of the right eyelid was noted by the doctor who attended her, but the mother said it has been present since infancy, and this is corroborated by photographs. She made a good recovery. This was possibly a previous attack of encephalitis.

Three months before admission she began to have attacks of hiccup two or three times a week; the attack would last a few minutes and then stop spontaneously.

Two months before admission she became acutely ill with severe headache. She slept all day, was hard to rouse, and became "a little light-headed at night." She vomited several times and the temperature is said to have been 104° F. She was in bed two days, and on getting up found that objects looked blurred, and she saw double, and has done so ever since—has felt languid and has had occasional attacks of hiccup as before.

Eight days before admission an attack of hiccup began which continued until admission; and she did not sleep at all on the previous night. The mother states that the patient has been always rather excitable, but more so since her illness two months ago.

Condition on Admission.

Mental State.—On admission she was restless, excitable, and talkative; smiling and laughing during examination. In spite of having hiccupped persistently for eight days she was apparently in no way depressed or fatigued by her condition, but, on the other hand, was rather amused at it; she was able to give an intelligent account of her illness; and her memory was unimpaired. Her mental state was thus similar to that of the myoclonic cases described by Ellis, though the excitement was less extreme and there was no delirium.

Hiccup.—When admitted she was hiccupping about 120 times a minute. Synchronous with each contraction of the diaphragm was a relaxation of the musculature of the abdominal wall and a sharp dilatation of the alae nasi. The frequency of the hiccup was diminished during speech, but it was not completely inhibited and often cut short a word; laughter caused a similar partial inhibition. She complained of a sensation of stiffness around the lower ribs. The hiccup ceased as soon as she was given a hot bath, within two hours of admission, and before she had had any sedative drug.

Myoclonic movements occurred in the upper limbs and the abdominal walls, but have never been very marked. In the upper limbs there were slight jerking movements of flexion of the elbow, wrist, and fingers, and pronation of the forearm occurring every few seconds. In the abdomen even before the hiccup ceased slight twitches of the abdominal muscles were seen, which did not occur so frequently and did not synchronize with it. When the hiccup ceased it was possible to examine these movements alone. They occurred seven or eight times a minute almost entirely in the upper abdomen and chiefly in the upper right quadrant, the umbilicus being drawn sometimes straight upwards, but usually obliquely upwards and to the right. The movements were associated with a weakness of the upper abdominal wall for voluntary movement, the umbilicus moving downwards when the head was

raised from the pillow against resistance. The abdominal reflexes are of interest; the response in the right upper segment was very brisk as compared with the reactions in the other segments, and consisted of a sharp primary twitch, followed by a series of smaller twitches occurring at irregular intervals for several seconds. The reflexes on the left side and in the lower segments on the right side were normal. The myoclonic movements were thus associated with an increased reflex excitability of the same segment of the abdominal wall.

Cranial Nerves.—The fundi were normal, vision was unimpaired, and the visual fields normal. Photophobia was present, with a reflex spasm of the orbicularis oculi on illuminating the homolateral eye. The pupils were somewhat dilated, equal and regular. There was an extremely sluggish and unsustained reaction to light and on accommodation, but a slightly brisker response on convergence, which was poorly carried out. There was a slight weakness of the external rectus on each side with a corresponding convergent strabismus and diplopia on extreme lateral fixation to either side. Slight ptosis of right eyelid. No nystagmus. The uvula was drawn to the right on phonation. The other cranial nerves and the remainder of the nervous system showed no abnormality.

Condition One Month after Admission.

She had had no recurrence of the hiccup (August 15th), but was still abnormally sleepy at times, and occasionally complained of pain behind the eyes. The mental excitability was less pronounced, but the myoclonic movements were slightly more marked. Involuntary elevation of the eyebrows and blinking of the eyes were noted, while, in addition to the movements described before, occasional contractions were observed in the sternomastoids, the pectorales, the small muscles of the hands, and both quadriceps extensors; flexion and extension of the toes also occurred. The abdominal movements were unchanged; there was some flattening of the right upper segment on raising the head against resistance; the abdominal reflexes were brisker on the right than on the left, especially in the right upper segment, where the response still consisted of a series of three or four successive twitches. The cranial nerve palsies were less marked. The response of the pupils to light was brisker, as was also the reaction on convergence. The reaction on accommodation was still sluggish and ill sustained. Photophobia was still present. The weakness of the external recti was extremely slight, there being now no obvious strabismus, and only slight blurring of the image on extreme lateral fixation to either side. The slight ptosis of the right eyelid was unchanged.

When in 1917 von Economo first described the condition the well known lethargic type of the disease, with somnolence, lethargy, and ocular palsies leading to ptosis, strabismus, and pupillary disturbances, greatly predominated. Later it began to be realized that the manifestations were much more varied and widespread. The occurrence of cases closely resembling paralysis agitans began to attract attention, and still later the excited and myoclonic and choreiform types of the disease and the occurrence of epidemic hiccup became recognized.

In the excited and myoclonic patients and in epidemic hiccup the lethargy so typical of the more ordinary forms of the disease is replaced by mental excitement, delirium, and insomnia. Cases in which myoclonic movements were present occurred sporadically in 1918, but it was not until the end of 1919 that they became prevalent. They were described as a form of acute epidemic encephalitis in January, 1920, by Sicard and Kudelski, and Ellis¹ reported three cases in this country in that year. The characteristic of this variety is the occurrence of twitching of the muscles of the limbs, and rhythmic shock-like movements of the abdominal muscles, which may be so severe as to shake the bed with each contraction. Cranial nerve palsies may or may not occur.

Although cases of hiccup were noted by von Economo in 1917, hiccup did not occur in epidemic form until the end of 1919, when an outbreak coincided with the epidemic of the myoclonic form. Hall² quotes Boyd as describing an outbreak of epidemic hiccup which occurred in Winnipeg in the autumn of 1919, and preceded an outbreak of the lethargic form of the disease. The same authority quotes Dargein and Plazy, who describe a case in which lethargy and ocular palsies developed a fortnight after recovery from an attack of epidemic hiccup. But Hall concludes that "at the present time no dogmatic statement of the relationship of the two conditions seems warranted."

CONCLUSION.

The above case, therefore, is of interest. The patient after suffering for a month from intermittent brief attacks of hiccup, developed a typical though mild attack of the lethargic form of encephalitis with ocular

palsies. Two months later, after further brief attacks of hiccup, an attack of hiccup developed which lasted eight days, and for which she was admitted to the London Hospital. On admission she exhibited cranial nerve palsies, hiccup, and also myoclonic movements of the arms and abdominal wall. This would seem to establish finally the relationship between epidemic hiccup and epidemic encephalitis.

It is therefore not surprising that the epidemics of hiccup and myoclonic encephalitis should have coincided in 1919, since hiccup is probably a myoclonus of the diaphragm. In this patient as in the case recorded by Dargein and Plazy the hiccup preceded the development of the lethargic symptoms.

A further point of interest is the occurrence in this patient of an acute illness with lethargy and delirium in November, 1918. If, on the rather scanty evidence obtainable, this be accepted as a previous attack of epidemic encephalitis, the present illness must be regarded as a recurrence of the disease after the long interval of four years and six months.

It will be seen that in this one patient the majority of the varying types of this interesting disease are apparent and that the history of the individual reproduces more or less accurately the history of the development of our knowledge of epidemic encephalitis.

REFERENCES.

- ¹ Ellis, A. W. M.: *Lancet*, 1920, ii, 114. ² Hall, A. J., *Ibid.*, 1923, i, 731.

British Medical Association.

PROCEEDINGS OF SECTIONS AT THE ANNUAL MEETING, 1923.

SECTION OF DISEASES OF CHILDREN.

EDMUND CAUTLEY, M.D., F.R.C.P., President.

DISCUSSION ON SUMMER DIARRHOEA.

OPENING PAPER

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SINCE the early days of scientific bacteriology many investigators have paid attention to the micro-organisms present in cases of summer diarrhoea with the view of isolating the causal agent. Some of the earliest investigations are of little more than historical interest, inasmuch as the differentiation of allied forms as we now know them was in its infancy. I have not the time or space at my disposal to give you a detailed account of all the investigations which have been carried out upon this subject, so shall content myself by giving a summary of the findings of previous investigators.

Booker and Escherich were among the first to study the flora in intestinal disease, but they did not find a specific organism for diarrhoea. Amongst the organisms isolated by Booker were *B. coli communis*, *B. lactis aerogenes*, *B. proteus vulgaris*, and streptococci, any one of which Booker thought might play a part in the different types of the disease studied by him.

Klein in 1897 and 1898 isolated the *B. enteritidis sporogenes* from a small number of cases and regarded it as the causal organism of summer diarrhoea.

It was about this time (1898-1900) that Shiga, Kruse, and Flexner discovered the bacillus of dysentery, and in 1902 Duval and Bassett isolated dysentery bacilli from 42 out of 53 cases of infantile diarrhoea. These authors come to the conclusion that the dysentery bacillus "is an important, if not the most important, cause of summer diarrhoea in children." In 1903 the Rockefeller Institute undertook, under Dr. Flexner's direction, a comprehensive investigation in several large American cities on the occurrence of the dysentery bacillus in the summer diarrhoea and other

diarrhoeal diseases of children. Dysentery bacilli were isolated in 63.2 per cent. of the 412 cases investigated. They were mainly of the Flexner-Harris-type, but the Shiga type was also met with, and occasionally the two types were associated. Other atypical forms were also isolated. Flexner, in his conclusions, stated that it is probable, though not proven, that *B. dysenteriae* appears at times among the saprophytic bacteria of the intestinal contents. He states also that streptococci in large numbers were frequently grown together with the dysentery bacilli, but that the relative parts played by each in the production of the intestinal lesions and the symptoms of the disease is not established by the investigation. Nor is the possible action of any other of the many bacteria of the discharges excluded by the special findings of this investigation. Other American observers, among them Wollstein, Park Collins and Goodwin, Duval and Schorer, Cordes, Weaver and Tunncliffe, and Graham of Toronto, have reported epidemics associated with the dysentery bacillus.

In connexion with the frequent isolation of the dysentery bacillus by many American observers and its rarity in our English cases of the disease, attention must be drawn to the fact that the clinical types of summer diarrhoea as studied in the two countries appear to differ. In the American type of case the stools very frequently contained blood and mucus, and hence were more like the stools passed in true epidemic or asylum dysentery. In cases seen in this country the stools are variously described as green, slimy, watery or curdy, and offensive; blood is only occasionally present and mucus perhaps more frequently.

On the other hand, we find that Park Collins and Goodwin, and Schwarz in America, and Jehle and Charleton in Vienna, never isolated dysentery bacilli from cases of acute gastro-enteritis with the characteristic stools we are familiar with in this country. The last named observers considered that summer diarrhoea might be caused by various forms of micro-organisms of a non-dysenteric type, more particularly by *B. coli communis*.

In 1905 and 1906 Morgan studied the bacteriology of the disease in London children and isolated a considerable number of bacilli of the non-lactose fermenting type. These investigations were continued by Morgan and Ledingham in 1907 and 1908, and their presentation of the results obtained and the conclusions they drew from them to the Epidemiological Section of the Royal Society of Medicine in February, 1909, evoked an interesting discussion from epidemiologists and bacteriologists.

The outcome of the prolonged investigation was that a certain organism—Morgan's No. 1 bacillus—was proved to occupy a predominant position among the non-lactose fermenters in the excreta of summer diarrhoea patients. "In selected cases of the disease" it was isolated from 63 per cent. The strains isolated in 1905 and 1906 were pathogenic to young rats, rabbits, and monkeys by feeding; diarrhoea was produced, followed by death. The 1907 and 1908 strains were found to be much less pathogenic to animals by feeding.

Agglutination reactions with the serums of patients yielded far less satisfactory results than had been obtained by the American investigators. In 1905 Morgan found only one of the 44 serums tested agglutinating its own bacillus. In 1908 positive results were obtained in a larger proportion of the cases, 30 out of 65 cases tested giving a positive reaction with Morgan's bacillus, but the dilution in which the reaction was obtained never exceeded 1 in 40. The best results were obtained at or near convalescence.

Morgan's bacillus is a motile, small, Gram-negative organism which grows well on ordinary media, produces acid and a little gas in glucose and no change in lactose, dulcitate, saccharose, or mannite. Litmus milk is unchanged in one and three days, but slightly alkaline on the fifteenth day. Indole is produced and gelatin is not liquefied. Morgan and Ledingham came across two variants of this type, both of which were non-motile and one of them not producing indole. It will be noted that the variant which was non-motile and indole-negative differs from Shiga's dysentery bacillus only by the production of a little gas in glucose media. Morgan himself, in his 1907 paper, draws attention to the fact that some of the properties of his No. 1 bacillus may vary—particularly the amount of gas produced from glucose. This, he says, may be so slight that